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Brazilian Economic Integration and challenges in the trade balance: an analysis using the classification by broad economic categories

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Abstract: The article analyzes the Brazilian trade balance according to the Classification by Broad Economic Categories and tests the stability of import demand using Ordinary Least Squares regressions and Bai and Perron (2003) structural break tests, with monthly data from 1997 to 2023. The results indicate a deterioration in Brazil's integration into international trade, with deficits in sophisticated sectors and surpluses in basic activities. Instability in import demand coefficients is observed during periods of high economic activity and the 2009 crisis. It is concluded that Brazil needs industrial policies to reverse this unfavorable external integration.

Keywords: Economic growth; industry; foreign trade; imports; structural change.
JEL Classification: F41; O24; L60; E60.

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INTRODUCTON

Throughout history, countries that have advanced to high levels of per capita income have relied on industry as the foundation enabling them to achieve this goal (Pessoti and Pessoti, 2009). Alongside industry, the external sector has also figured out as a relevant actor, receiving special attention from the economic development literature. Anglo-Saxon structuralism focused on the determinants of industrialization and on the main measures necessary to overcome the economic backwardness of Eastern and Southeastern European countries. In turn, Latin American structuralism deepened the study of the importance of industrialization and innovated by incorporating into the analysis the influence of foreign trade on the productive dynamics of peripheral or underdeveloped countries.

At the core of this discussion lies the hypothesis of the deterioration of the terms of trade. This hypothesis argues that if export volumes remain stable, the purchasing power for foreign goods and services progressively decreases in countries specializing in the export of primary products, as the prices of these goods tend to decline over time. Since peripheral countries are exporters of primary goods and basic manufactures, industrialization and the gradual advancement into the production of sophisticated manufactures constitute

the path they must pursue to mitigate the negative effects of falling primary commodity prices on the Balance of Payments (BP).

Concurrently with the theoretical formulations of the Economic Commission for Latin America and the Caribbean (ECLAC), post-Keynesian scholars such as Kaldor (1966) and Thirlwall (1979) developed new explanations for the differing economic growth rates among countries. Noteworthy here are Kaldor's laws, which demonstrate: (i) that industry is the dynamic core of the economy, given the positive relationship between industrial growth and aggregate output growth; (ii) the existence of a causal relationship between the productivity growth rate and the output growth rate (Kaldor-Verdoorn law); (iii) the presence of a positive association between the growth rate of exports and output growth, as the latter generates the necessary conditions to access foreign markets; and (iv) that long-term economic growth is not supply-constrained but rather demand-constrained. This last law argues that the main demand-side constraint on output growth in an open economy is the balance of payments, as it reflects the sectoral composition of the economy and the income elasticities of demand for exports (Missio *et al.*, 2015).

This last law leads us to Thirlwall (1979), who places BP equilibrium at the center of the debate on the factors responsible for differences in growth rates among countries. The main policy recommendation is that, to sustain higher growth rates compatible with BP equilibrium, exports must become more competitive, and the income elasticity of import demand must be reduced. Structural change policies that promote exports and encourage import substitution should be at the core of the policy agenda for countries aiming to achieve sustained development.

As highlighted by multisectoral models inspired by Keynesian/Kaldorian and neo-Schumpeterian literature (Araujo and Lima, 2007; Dosi *et al.*, 2022), the sectoral composition of the economy is decisive for understanding external constraints on growth. These studies emphasize that differences in the income elasticities of exports and imports across sectors can alter the growth rate compatible with external balance, especially when considering structural change within industry itself. However, this article adopts the Classification by Broad Economic Categories (BEC). This choice is justified by its ability to provide a complementary perspective to traditional sectoral analysis, as the BEC organizes trade flows according to the intended use of goods (capital goods, intermediate goods, durable and non-durable consumer goods, and fuels). This approach is particularly relevant for measuring the strategic role of intermediate inputs, which are a central link in Global Value Chains and whose evolution directly influences the competitiveness and international integration of industry. Moreover, by distinguishing trade flows according to the economic function of goods, the BEC identifies changes in the structure of external and domestic demand that may not be fully visible through purely sectoral classifications.

Given the importance of industry and the external sector for economic growth, this article aims to characterize Brazil's trade balance, disaggregated according to the BEC, and to assess the stability of the coefficients associated with the import demand equation. The methodological procedure adopted includes the compilation of descriptive statistics, estimation of regressions using the Ordinary Least Squares method, and implementation of structural break tests. The database has monthly frequency, with information covering the period from January 1997 to September 2023.

The motivation for this study lies in the need for research that seeks to understand the challenges faced by Keynesian growth and development policies. In countries with an incomplete industrialization process, such as Brazil, the adoption of demand-stimulus policies may result in unexpected changes in the coefficients associated with the import demand equation. Other factors, such as changes in government policy, external and internal shocks, and shifts in agents' expectations, can also alter the coefficients of the variables that comprise import demand. Therefore, identifying instabilities in these coefficients is necessary to alert policymakers to the need for caution and adjustments in their strategies to avoid possible future constraints.

To meet the proposed objective, the text is divided into five parts, including this introduction and the conclusion. The second section revisits Latin American structuralist theory, emphasizing the foreign trade dimension, and subsequently discusses both the canonical model (Thirlwall, 1979) and the multisectoral model (Araujo and Lima, 2007), to highlight the importance of productive structure and its effects on the BP. The third section presents methodological procedures, and the fourth section discusses the results obtained.

LITERATURE REVIEW

The External Sector In Latin American Structuralism

Historically, external economic issues have been a source of concern for economists focused on economic development. In Latin America, the works of Aníbal Pinto, Celso Furtado, Raúl Prebisch, Oswaldo Sunkel, and Octavio Rodriguez systematized the thinking of the Economic Commission for Latin America and the Caribbean (ECLAC), whose main foundations include: (1) the center-periphery relationship; (2) productive heterogeneity; and (3) the deterioration of the terms of trade (Bielschowsky, 1998; Rodriguez, 2009).

Prebisch (1949), when analyzing the economic characteristics of Latin American countries and their trade interactions with the rest of the world, proposed the existence of a systemic polarity between the Center and the Periphery. The Center refers to developed countries characterized by an advanced industrial structure, while the Periphery encompasses underdeveloped countries and primary-product exporters. Given the unique capacity of industry to foster structural transformations, thanks to increasing returns to scale and broad technological spillovers, the global economic structure appeared unfavorable to Latin American countries (Furtado, 1961).

As Prebisch (1949, p.83) noted: "[...] while the centers have preserved in full the fruits of the technical progress of their industry, the peripheral countries have transferred to them part of the fruits of their own technical progress." In other words, core countries have a homogeneous economic structure, organized labor unions, and lead the generation and dissemination of technical progress, whereas the periphery comprises countries with heterogeneous economic structures, fragmented unions, and technological dependence. Consequently, the periphery would tend to remain in its primary-exporting condition.

The central point is that, when comparing economies producing primary goods with industrialized countries, structuralists observed that the productivity of developed countries was higher, suggesting a dichotomy in the productive structure characterized by the structural heterogeneity found in the Periphery (Furtado, 1961; Pinto, 1970; Prebisch, 1949). Two structural deficiencies can be cited: (1) external in origin, stemming from adverse international trade conditions and limited import capacity; and (2) internal in origin, arising from accelerated population growth and urbanization, expansion of the service sector, lagging agricultural production, an underdeveloped domestic market, and an inefficient tax system.

Moreover, Prebisch (1949) identified the greatest problem in the periphery as the heterogeneity of productivity levels across sectors. According to Pinto (1970), there are three main structures: (i) a "primitive" structure, which exhibits the lowest labor productivity levels, similar to those found during the colonial period; (ii) at the other extreme, a "modern" structure, whose productivity levels are close to the average of developed countries; and (iii) an "intermediate" structure, which falls between the two.

Under these conditions, heterogeneity and specialization in primary production tend to generate recurrent pressures on the balance of payments (Furtado, 1961; Prebisch, 1949; Rodriguez, 2009; Rodriguez *et al.*, 1995). Peripheral countries come to depend on the value of primary-product exports to finance imports. However, the international prices of these goods are subject to sharp declines during crises and display a long-term downward trend, a phenomenon referred to as the deterioration of the terms of trade.

The deterioration of the terms of trade, arising from foreign trade, reflects the region's productive structure, which reinforces itself over time. According to Rodriguez (2009), there are three ways to analyze the deterioration of the terms of trade: (1) the accounting version, which does not investigate the causes but seeks to explain why this phenomenon implies differences in the average real income levels between the Periphery and the Center; (2) the cycles version, which is essentially based on the growing inequality between wages in the Periphery and in the Center, and the structural conditions that induce it; and (3) the industrialization version, which seeks to link deterioration and income differentiation with the periphery's industrialization process. In this view, deterioration results from differences between the income elasticities of import demand in the Periphery and the Center, as well as inequalities in technological penetration, labor productivity, and wages between them.

The solution to overcoming problems of productivity, technological backwardness, and balance-of-payments disequilibrium, and ultimately underdevelopment, lies in the industrialization of Latin American countries. Industrialization would enable these countries to capture the fruits of technical progress and raise living

standards. However, given existing structural conditions, the industrialization process would be a long path to follow.

In this regard, Furtado's writings point to: (i) a low capital-labor ratio, indicating low labor productivity; (ii) the absence of a capital-goods-producing sector; and (iii) a poorly diversified (specialized) production structure focused on goods with low technological content. On the other hand, the author argues that the initial development impulse in these economies came from abroad: (i) through demand for their production; (ii) via a "demonstration effect" that drives local groups to seek development (either to improve the country's general condition or simply to raise their own consumption level); and (iii) through the transfer of capitalist enterprises to the periphery (Furtado, 1961, 1986).

Against this structural backdrop, Latin American countries embarked on industrialization processes, in most cases with the State as the driving force. Over time, the State assumed various roles, including regulator, producer, intervener, and investor. In partnership with the private sector, both domestic and international, it built industrial structures. However, Latin American industrialization, defined as Import Substitution Industrialization (ISI), can be considered late, lagging, and incomplete compared to Europe, reflecting a range of conjunctural determinants and the dynamics of capital accumulation (Fajnzylber, 1980; Tavares, 1980).

Thirlwall's Law as the Link Between Productive Structure and Balance of Payments Performance

Balance-of-payments-constrained growth models rest on the hypothesis that equilibrium must be maintained in the long run. Otherwise, aggregate demand adjustments must occur, implying a constraint on economic growth. In other words, as the economy grows, imports tend to follow the same trajectory, meaning that financing this process must occur through increased exports or capital inflows. If exports are unable to offset the rise in imports, economies must be able to restore equilibrium through external financing. However, the impossibility of financing these deficits indefinitely imposes a constraint on economic growth, so that the productive structure and the pattern of specialization in foreign trade help explain long-term economic performance.

Thirlwall's (1979) canonical model is emblematic in showing that economic growth is closely linked to the growth rate of exports and to the income elasticity of import demand. The main policy recommendation is that, to sustain higher growth rates compatible with balance-of-payments equilibrium, exports must be made more attractive, and the income elasticity of import demand must be reduced. That is, structural change policies aimed at boosting exports and import substitution should be at the center of attention for policymakers in countries seeking to promote a sustained development process.

Incorporating the balance of payments into the explanation of differences in countries' economic growth rates opened the way for developments with a sectoral focus, as in the studies by Araujo and Lima (2007), Gouvêa and Lima (2013), Marconi and Araujo (2016), and Teixeira and Missio (2021). According to Araujo and Lima (2007), the natural extension for addressing balance-of-payments-constrained growth compatible with external equilibrium comes from a Pasinetti-inspired multisectoral approach. The authors use the north-south model version of Araujo and Teixeira (2004) to incorporate a multisectoral dimension, in which the rate of change of demand is distinct for each sector of the economy. The Multisectoral Thirlwall's Law, as determined by Araujo and Lima (2007), proposes that a country's per capita growth is directly proportional to its export growth rate, so that it will benefit from increased external demand, under balance-of-payments equilibrium conditions,2 if its sectoral income elasticities of import demand are lower and its sectoral income elasticities of export demand are higher.

Because this is a multisectoral approach, sectoral export and import elasticities must consider each sector's share in total foreign trade. Under these circumstances, even if elasticity remains constant, structural change can affect the growth rate compatible with external equilibrium. The clearest implication of this proposition is that changes in the composition of demand or in the productive structure matter for economic growth. This is why not only industry matters for economic growth, but also the direction of structural change within the industrial sector itself, which explains the economic performance of economies undergoing accelerated development.

Therefore, Latin American structuralism and Thirlwall's Law, in both its canonical and multisectoral versions, are complementary. Both theoretical approaches show that the external sector and the type of productive structure matter, as they affect the balance-of-payments equilibrium and, consequently, economic growth rates. In this sense, analyzing import performance, the evolution of industry's share in foreign trade, and the stability of coefficients associated with import demand is important for assessing the degree of external constraint faced by the Brazilian economy.

Although much of the literature uses strictly sectoral breakdowns of economic activity, in this study we chose to employ the BEC classification. This choice stems from two main reasons: (i) the BEC organizes trade flows according to the intended use of goods, capital goods, intermediate goods, durable consumer goods, non-durable consumer goods, and fuels, allowing us to identify changes in the profile of external and domestic demand that are not fully captured by sectoral classifications; and (ii) this typology highlights the importance of intermediate goods as strategic inputs in Global Value Chains, whose evolution is closely tied to industrial competitiveness and the pattern of trade specialization. Thus, the use of the BEC provides an alternative but theoretically consistent framework, offering a complementary perspective to assess the link between productive structure, foreign trade, and the external constraint on growth.

METHODOLOGICAL PROCEDURES

The variables comprising the database were tabulated with monthly frequency for the period from January 1997 to September 2023, totaling 321 observations, as shown in Table 1. The import index was extracted from the database provided by the Secretaria de Comércio Exterior (SECEX), deflated by the United States Producer Price Index, obtained from the Federal Reserve Bank of St. Louis (FRED). The economic activity level was tabulated based on real variation data of Gross Domestic Product (GDP), final consumption, provided by the Institute for Applied Economic Research (IPEA), deflated by the General Price Index – Internal Availability (IGP-DI). The real effective exchange rate (R$/US$) was also extracted from the IPEA database. Additionally, the industrial capacity utilization rate, provided by IPEA, was included in the analysis to measure the proximity of the productive structure to full utilization.

Table 1: Description of the time series included in the database

Abbreviation	Description	Source
m_t	Sector imports (FOB), US$, in logarithm	Secex (2024)
y_t	Gross Domestic Product (GDP) – IGP-DI, 1997.01=100, R$ (millions), in logarithm	IPEA (2024)
e_t	Real effective exchange rate – IPA-EP-DI, in logarithm	IPEA (2024)
c_t	Capacity utilization, industry, index (2006 average = 100), in percentage	IPEA (2024)
p_t	Producer price index by sector: Total manufacturing industry in logarithm	IPEA (2024) and FRED (2024)

Source: The authors

The Bai and Perron (2003) test uses a dynamic algorithm, based on Bellman's optimization principle, to identify the m breakpoints that minimize the Sum of Squared Residuals (SSR) in a model with m+1 segments:

$$(\hat{\imath}_1, \cdots, \hat{\imath}_m) = argmin_{(\hat{\imath}_1, \ldots, \hat{\imath}_m)} SQR(\hat{\imath}_1, \cdots, \hat{\imath}_m) \quad (1)$$

where:

$$SQR(i_1, \cdots, i_m) = \sum_{j=1}^{m+1} sqr(i_{j-1}, \cdots, i_j) \quad (2)$$

The application of this test occurs over a segment of minimum size n x h with h normally set to 0.1 or 0.15. In this study, the Bai and Perron (2003) test is applied to the import demand equation:

$$m_{s,t} = \alpha_0 + \alpha_1 y_t + \alpha_2 e_t + \alpha_3 c_t + \alpha_4 p_t + \epsilon_t \quad (3)$$

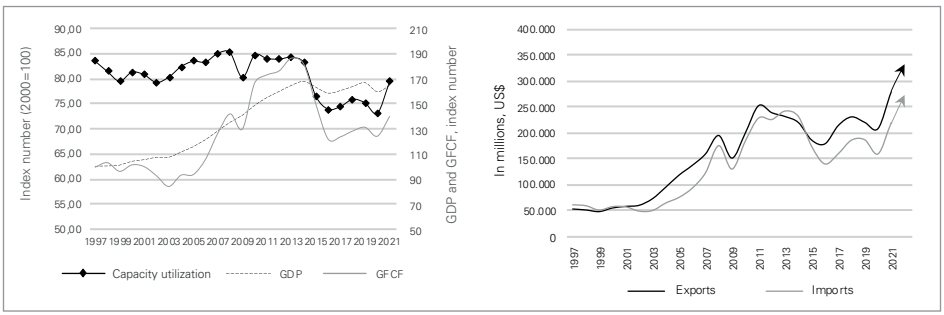
where $m_{s,t}$ represents imports by sector s, classified according to the BEC classification, y_t is the Gross Domestic Product, e_t is the exchange rate, c_t is the capacity utilization rate, p_t is the relative price index, and ε_t is the error term.

RESULTS

Descriptive Statistics

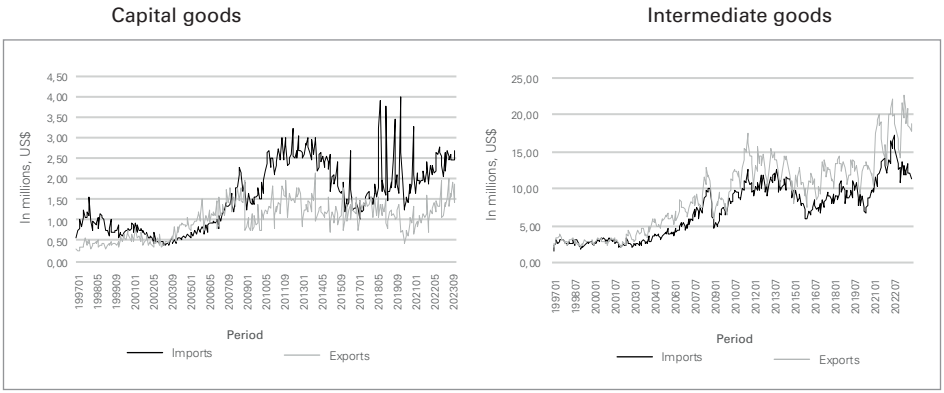
Brazil experienced a period of strong economic growth between 2003 and 2014 (Figure 1). Periods of economic expansion and crisis were accompanied by Gross Fixed Capital Formation (GFCF), deflated by the IGP-DI (1997=100), and by the industrial capacity utilization rate.

Figure 1: Evolution of selected macroeconomic indicators, period 1997-2021



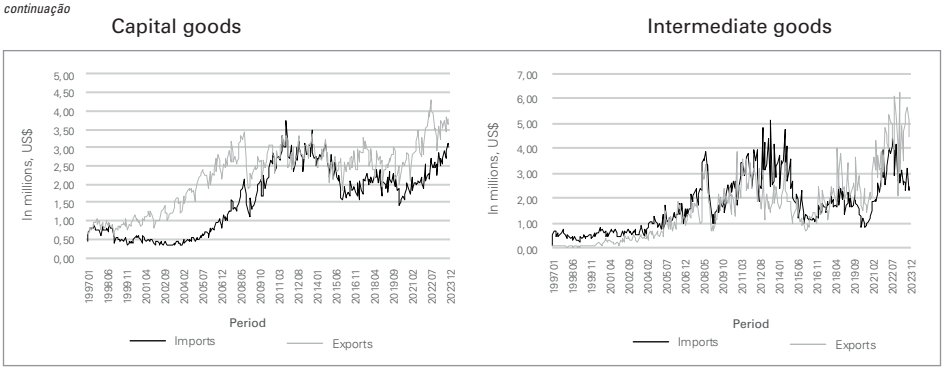
Source: IPEA (2024) and SECEX (2024).

Figure 2: Imports and exports by BEC, nominal values, 1997–2022, in billion US$



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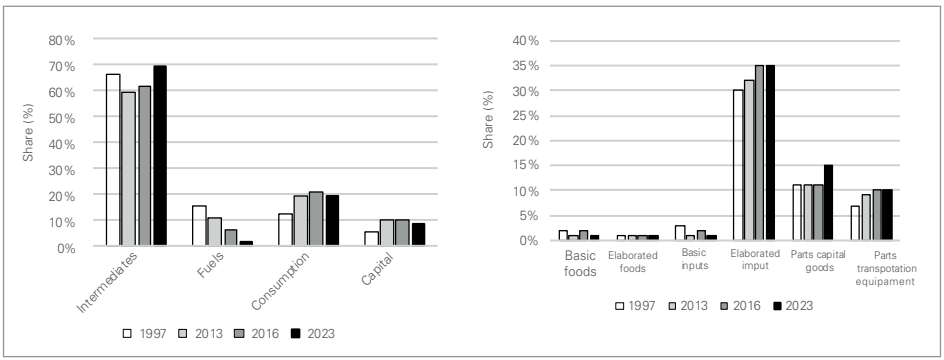


Source: SECEX (2024).

Despite these similarities, significant differences were observed among sectors. Intermediate and consumer goods showed trade surpluses throughout nearly the entire period analyzed. In contrast, the capital goods sector recorded a trade surplus only from May 2003 to December 2007. Fuels and lubricants exhibited a trade surplus starting in June 2016. These data highlight the chronic trade deficit in the capital goods sector, consistent with the Brazilian economic literature, which shows that although the country implemented policies to promote entry into this sector from the 1950s to the 1970s, the large initial investment required, the presence of oligopolistic groups in the international market, and the unavailability of technology limited its development (Tavares, 1980).

The intermediate goods sector has the largest share, as shown in Figure 3, accounting for 54% of Brazilian imports in 1997, rising to 61% in 2023. This increase occurs in parallel with a decline in capital goods imports, from 20% in 1997 to 14% in 2013 and 12% in 2023. The capital goods sector also shows a persistent decline regardless of the economic cycle phase, while the opposite is true for the fuels and lubricants sector, whose imports rose in response to economic activity growth, from 11% in 1997 to 18% in 2013, then declined during the economic crisis to 10% in 2016, with a recent increase to 13% in 2023.

Figure 3: Sectoral share of imports, 1997–2023)



Source: SECEX (2024), mainly destined for industry.

The high share of the intermediate goods sector is mainly explained by the import of manufactured industrial inputs, which increased substantially from 30% in 1997 to 35% in 2023. The share of parts for transport equipment also grew significantly, from 7% in 1997 to 10% in 2023.

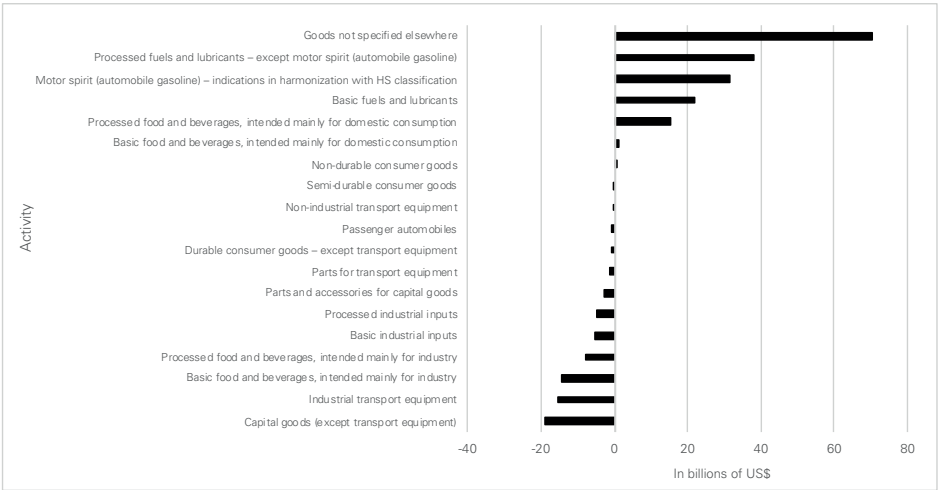
Thus, despite the decline in capital goods imports, Brazil's dependence on more sophisticated inputs used by industry increased, a phenomenon likely explained by deindustrialization. Brazilian deindustrialization is characterized precisely by the import of goods associated with production stages that were previ-

ously performed domestically. The literature uses various terms to describe this phenomenon: demand leakage abroad (Sarti and Hiratuka, 2018), substitution of domestic inputs by imports (Marconi and Rocha, 2012a, 2012b), unraveling of the production structure (Morceiro, 2012; Morceiro and Guilhoto, 2019), regressive specialization (Coutinho, 1997), loss of production chain links (Cano, 2012; Feijó *et al.*, 2005), thinning of production chains (Comin, 2009), maquiladora effect (Marconi and Rocha, 2012b, 2012a), productive hollowing-out (Cassiolato *et al.*, 2015), productive de-densification (Sarti and Hiratuka, 2018).

As highlighted by Sarti and Hiratuka (2018), intermediate goods still hold significant weight in the Brazilian economy. The data evidences a growing dependence on imports of sophisticated intermediate goods, representing a pernicious aspect of the contours assumed by the process of productive restructuring, resulting in a regressive specialization process.

Activities with a positive change in trade balance between 1997 and 2023 (Figure 4) are of low sophistication, notably basic food and beverages, mainly destined for industry, and basic industrial inputs, as well as basic fuels and lubricants and processed food and beverages for industrial and domestic consumption. Conversely, among activities with negative changes in trade balance, those with high sophistication stand out, primarily in the intermediate goods sector (parts and accessories for capital goods and manufactured industrial inputs), along with specific activities in the consumer goods sector (non-durable and semi-durable goods) and capital goods sector (capital goods excluding transport equipment).

Figure 4: Change in trade balance between 1997 and 2023 by subcategory, level 3, BEC classification, in billion US$



Source: SECEX (2024), mainly destined for industry, mainly destined for domestic consumption, excluding transport equipment.

Therefore, the data support the argument that Brazil underwent a regressive structural change, characterized by high dependence on imported intermediate goods (Miroudot *et al.*, 2009). The increased dependence on imports of sophisticated industrial inputs and capital goods means the economy has become more vulnerable to periodic pressures on the Balance of Payments (Furtado, 1961; Prebisch, 1949; Rodriguez, 2009; Rodriguez *et al.*, 1995). Deindustrialization and unraveling of the productive structure not only lead to increased imports of intermediate inputs but may also impair economic growth rates by making the country more dependent on external technological progress and increasing external constraints (Morceiro, 2012; Morceiro and Guilhoto, 2019). As noted by Morceiro and Guilhoto (2019, p.2), the rise in imports of components and inputs with higher technological sophistication "may exacerbate deindustrialization by reducing the transformation of industrial operations and increasing assembly stages with low-skilled and low-wage

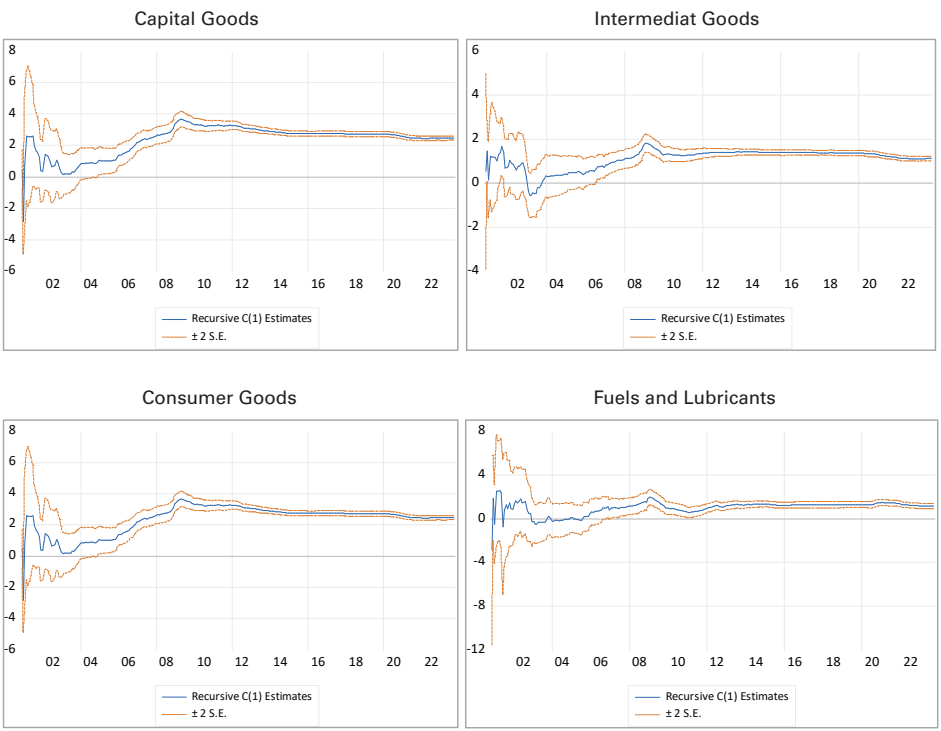
labor, thus generating less value added," while also contributing to distancing the country from the technological frontier.

Regarding the origin of Brazilian imports by BEC category, in 1997 the United States accounted for 33% of capital goods imports; Germany, 13%; Italy, 10%; and Japan, 9%. However, the origin of imports changed significantly over the period analyzed. By 2023, China became the primary source of imports, representing 27%. China's increased share occurred mainly at the expense of the United States, whose share dropped to 18%. The intermediate goods sector also experienced profound changes: in 1997, 25% of imports originated from the United States, 10% from Argentina, and 9% from Germany. By 2023, China accounted for 26% of imports, while shares from the United States and Germany fell to 15% and 6%, respectively. A similar pattern is observed for consumer goods: in 1997, Argentina was the main source of imports (30%), followed by the United States (12%) and China (6%). By 2023, China accounted for 22% of imports, while Argentina's and the United States' shares declined to 11% and 7%, respectively.

Estimated Regressions

Two distinct procedures were used to analyze coefficient behavior. The first involved recursively plotting estimated coefficients to verify their stability over the analysis period (Figure 5). Results show that the increase in economic activity between 2004 and 2008 and the 2008 international crisis significantly altered import sensitivity to income, with Capital Goods and Consumer Goods sectors displaying the most unstable coefficients.

Figure 5: Stability of estimated income elasticity parameters for imports



Source: Authors.

Given the detected coefficient instability, regressions were re-estimated (Table 2) applying the Bai and Perron (1998) procedure, which identified five structural breaks for Capital Goods and Consumer Goods sectors, three breaks for Fuels and Lubricants, and one break for Intermediate Goods. For Capital and Consumer Goods, the first break occurred in May 2004. As noted by Santos *et al.* (2015), these results align with literature identifying import structural breaks in the early 2000s, a period marking the end of stagnation and the beginning of a strong growth cycle in economic activity and investment. Further breaks are observed in April 2009 (global financial crisis), July 2016 (China-US trade war), and February 2020 (Covid-19 pandemic).

Table 2: Results of estimated regressions by structural break periods

Capital Goods		Intermediate Goods		Consumer Goods		Fuels	
2000/06 – 2004/05		2000M06 – 2017/12		2000/06 – 2005/03		2000/06 – 2009/03	
0.495	0.328	1.382	0.000	1.017	0.041	1.868	0.000
0.032	0.981	3.922	0.000	3.305	0.000	6.282	0.000
-0.230	0.187	-0.339	0.000	-0.301	0.009	-0.299	0.036
1.168	0.000	-0.285	0.002	0.274	0.008	-0.870	0.000
-0.312	0.964	-28.779	0.000	-21.812	0.000	-44.896	0.000
2004/06 – 2009/04		2018/01 – 2023/09		2005/04 – 2008/09		2009/04 – 2017/11	
2.173	0.000	-0.306	0.192	2.512	0.000	3.689	0.000
2.672	0.020	2.192	0.000	3.514	0.001	1.581	0.202
-0.763	0.000	-0.353	0.025	-1.538	0.000	0.020	0.941
-4.526	0.000	-0.078	0.633	-2.565	0.003	2.118	0.000
-35.248	0.000	2.343	0.630	-38.627	0.000	-48.307	0.000
2009/05 – 2016/07		-		2008/10 – 2012/03		2017/12 – 2023/09	
2.512	0.000			2.688	0.000	-1.353	0.085
1.166	0.162			2.032	0.001	1.277	0.125
-0.675	0.002			0.520	0.054	-2.196	0.000
0.103	0.788			-2.573	0.000	0.299	0.559
-30.593	0.000			-44.203	0.000	31.437	0.016
2016/08 – 2020/02				2012/04 – 2020/03			
1.193	0.147			1.115	0.000		
3.244	0.190			3.377	0.000		
2.079	0.002			0.100	0.364		
-1.538	0.245			0.411	0.004		
-37.356	0.012			-24.285	0.000		
2020/03 - 2023/09				2020/04 - 2023/03			
1.846	0.000			1.617	0.000		
0.414	0.532			0.283	0.304		
0.131	0.502			-0.045	0.602		
-1.926	0.024			-1.268	0.000		
-24.987	2.000			-19.235	0.000		
0.90		0.94		0.98		0.82	

Source: Authors.

For Fuels and Lubricants, breaks distinguish the pre-crisis period before March 2009, the crisis period until November 2017, and the period of heightened international instability due to the China-US trade war starting November 2017. For Intermediate Goods, the Bai-Perron test identifies periods before and after December 2017.

The estimations confirm high instability in income elasticity for Capital Goods imports, which is not statistically significant at the 95% confidence level only for the segments up to May 2004 and between August 2016 and February 2020. Similar to findings in the literature (Table 3), income elasticity increases to 2.171 between June 2004 and April 2009, reflecting rising economic activity. After the 2009 crisis, it further rises to 2.512 between May 2009 and July 2016, then declines to 1.846 for the segment March 2020 to September 2023.

Table 3: Literature-reported income and exchange rate elasticities

Autor	Frequency	Period	Income Elasticity		Exchange Rate Elasticity	
			BI	BK	BI	BK
Portugal (1992)	Quarterly	1975 e 1988	1.0	1.3	-0.9	-0.5
Castro and Cavalcanti (1997)	Annual	1956 e 1995	1.2	1.0	-2.0	-2.2
Carvalho and Parente (1999)	Monthly	1978 e1996	1.3	1.3	-2.0	-1.9
Resende (2001)	Quarterly	1978 e 1998	3.5	3.5	-1.1	-1.5
Cavalcanti and Frischtak (2001)	Quarterly	1980 e 2000	2.8	1.9	-1.1	-1.5
Sapienza (2007)	Quarterly	1980 e 2006	-0.1	-2.0	0.7	0.8
Santos et al. (2015)	Quarterly	1996 e 2013	1.9	3.4	0.2	-0.4

Source: Adapted from Santos et al. (2015).

Similar behavior is observed for income elasticity of Consumer Goods and Fuels and Lubricants imports. For Consumer Goods, income elasticity is significant at the 95% confidence level for all breaks, rising through estimates to 2.689 by March 2012, and increasing again in the final segment to 1.617. These results indicate that import income elasticity rose during periods of stronger economic growth and after the international economic crisis. Indeed, demand stimulus policies implemented by the Lula government between 2004 and 2008 contributed to increased sensitivity of imports to economic activity. After the 2009 global crisis, developed countries saw growth rates decline, with part of their production redirected to developing countries like Brazil.

Subcategory analysis of intermediate and consumer goods (Appendices 1 and 2) confirms patterns identified for major categories but reveals heterogeneity in magnitude and statistical significance of elasticities. For income elasticity, intermediate goods subcategories such as Basic Foods and Basic Inputs show the highest values, especially after the 2009 crisis, exceeding aggregated category coefficients. Manufactured inputs and parts show more moderate and sometimes statistically insignificant elasticities, suggesting lower economic cycle responsiveness. Among consumer goods, durables are most sensitive, reaching 4.590 between 2010/11 and 2016/07; semi-durables and non-durables show lower, more stable values but follow the pattern of increase during expansions and decline during downturns.

These findings also highlight increased external dependence. The exchange rate elasticity, negative and significant until 2018, has approached zero and become statistically insignificant in some cases for more sophisticated intermediate inputs, suggesting that exchange rate depreciation lost effectiveness in curbing imports of these items. Additionally, elasticity with respect to installed capacity remains high and significant, indicating that increases in domestic demand translate into higher import volumes. These evidences points to greater structural dependence on sophisticated inputs with low substitutability by domestic production, making the country more vulnerable to external supply and price shocks regardless of exchange rate conditions.

FINAL CONSIDERATIONS

The objective of this study is to estimate import demand equations for Brazilian productive sectors, classified according to the Classification by Broad Economic Categories (BEC). Descriptive statistics, regressions using the Ordinary Least Squares (OLS) method, and the Bai and Perron (2003) structural break test were employed to characterize Brazilian imports and to test the stability of parameters associated with import demand, based on monthly data tabulated for the period between January 1997 and September 2023.

The descriptive statistics evidenced a growing deterioration in the way Brazil is integrated into international trade. The country began to observe a significant trade deficit in the sectors of intermediate goods, capital goods, and consumer goods, as reflected in the aggregated BEC data. This pattern, associated with the higher technological sophistication of these sectors, indicates a growing dependence on the import of inputs and final goods.

Furthermore, this scenario is influenced by the way Brazil is inserted into global value chains, primarily acting as a market for internationally organized products, which reinforces its external vulnerability. The country observed significant trade deficits precisely in the activities of the sectors of intermediate goods, capital goods, and consumer goods that exhibit higher sophistication, alongside growth in trade surpluses in basic activities with lower technological sophistication.

Therefore, although the country has presented a trade surplus in the most recent period, these data must be analyzed with caution because they mask the change in the trade balance composition, which results in greater external vulnerability. Deindustrialization, by increasing dependence on imported capital goods and intermediate inputs, can alter import demand elasticities as domestic production becomes more tied to the external sector.

The econometric analysis was conducted using aggregated data, which calls for caution when interpreting the results; this is complemented by the estimation of disaggregated regressions for intermediate and consumer goods. The results found for regressions estimated from June 2000 onwards showed that, beyond the structural component, attention must also be given to the effect of cyclical variables on import demand. The income elasticity of imports rose considerably during periods of higher economic activity and in response to the 2009 international economic crisis, and declined during the period of internal economic crisis, with a strong increase from 2020 onwards. This instability in elasticities highlights the need for caution when making future import projections, since they can underestimate or overestimate actual demand if they do not consider the internal and external economic scenarios and the effect of policies stimulating domestic demand on import demand behavior.

Subcategory analysis confirms overall patterns but reveals notable heterogeneity. Basic Foods and Basic Inputs have the highest income elasticities, especially post-2009, while manufactured inputs and parts show lower sensitivity. Among consumer goods, durables are most responsive to income changes, semi- and non-durables less so. These results highlight Brazil's growing dependence on sophisticated imported inputs with low domestic substitutes. Exchange rate depreciation has become less effective in curbing imports of these goods, while installed capacity became a strong driver of import volumes, underscoring the country's increasing vulnerability to external shocks.

Thus, the need for industrial policies is defended, aiming to reverse the harmful external insertion process observed in Brazil, through the adoption of productive deepening policies that seek to reverse the growing import trajectory of capital goods and intermediate goods, with emphasis on the more sophisticated activities associated with the intermediate goods sector, especially parts and accessories for capital goods, elaborated industrial inputs, and parts for transportation equipment. This is a necessary measure to reduce the external constraint on economic growth caused by the increase in imports during periods of domestic demand expansion.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

DATA AVAILABILITY

The data underlying this study are obtained from publicly available sources, including the Secretariat of Foreign Trade (Secex), the Institute for Applied Economic Research (IPEA), and the Federal Reserve Bank of St. Louis (FRED). The original databases can be accessed directly from these institutions.

The final analytical dataset used in the econometric estimations, constructed from the original sources through data cleaning, harmonization, and variable transformations, is not publicly available but can be provided by the corresponding author upon reasonable request to ensure replicability.

AUTHORS' CONTRIBUTION

Adilson Giovanini: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Resources; Software; Supervision; Validation; Visualization; Writing – original draft; Writing – proofreading, and editing.

Wallace Marcelino Pereira: Formal analysis; Investigation; Validation; Visualization; Writing – original draft; Writing – proofreading, and editing.

Appendix 1: Estimated Regressions for Intermediate Goods Subcategories

	Basic foods[1]		Processed foods[2]		Basic inputs[3]		Elaborated inputs[4]		Parts, capital[5]		Parts, transport[6]	
	2000/06-2009/09		2000/06-2005/12		2000/06-2009/06		2000/06-2018/01		2000/06-2018/11		2000/06-2018/11	
	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value	Coef.	p-value
β_0	-35.779	0.000	20.830	0.087	13.567	0.001	-4.441	0.294	-15.468	0.000	-19.960	0.000
y	1.478	0.001	-0.293	0.735	1.233	0.000	0.900	0.000	1.205	0.000	1.496	0.000
c	7.299	0.000	1.091	0.516	-1.924	0.052	3.533	0.000	4.980	0.000	4.849	0.000
e	0.916	0.002	-0.969	0.004	-0.600	0.002	-0.971	0.000	-0.513	0.000	-0.395	0.000
p	1.233	0.001	-1.929	0.000	0.322	0.199	-0.729	0.004	-0.884	0.000	-1.179	0.000
R_2	0.659	-	0.286	-	0.2678	-	0.7045	-	0.929	0.000	0.934	-
	2009/09-2023/09		2005/12-2012/09		2009/06-2015/08		2018/01-2023/09		2018/11-2023/09		2018/11-2023/09	
β_0	-41.736	0.000	-0.381	0.947	-22.419	0.006	-7.134	0.396	-3.453	0.595	-9.439	0.158
y	3.763	0.000	1.722	0.000	1.907	0.000	-0.018	0.976	0.730	0.112	0.911	0.054
c	3.469	0.027	-1.154	0.330	4.153	0.009	6.197	0.000	3.449	0.004	4.076	0.001
e	-1.015	0.000	0.016	0.954	-1.016	0.001	-0.196	0.402	-0.270	0.184	-0.171	0.409
p	0.832	0.000	-1.115	0.232	-1.937	0.070	1.990	0.000	-1.100	0.011	-0.606	0.160
R_2	0.791	-	0.762	-	0.861	-	0.682	-	0.581	-	0.509	-
	-	-	2012/09-2016/12		2015/08-2019/07		-	-	-	-	-	-
β_0	-	-	-24.593	0.106	-24.049	0.030	-	-	-	-	-	-
y	-	-	4.896	0.000	1.074	0.244	-	-	-	-	-	-
c	-	-	-7.660	0.015	5.845	0.042	-	-	-	-	-	-
e	-	-	0.984	0.032	0.290	0.305	-	-	-	-	-	-
p	-	-	-9.597	0.001	-0.337	0.184	-	-	-	-	-	-
R_2	-	-	0.539	-	0.343	-	-	-	-	-	-	-
	-	-	2016/12-2023/09		2019/07-2023/09		-	-	-	-	-	-
β_0	-	-	27.299	0.001	6.527	0.408	-	-	-	-	-	-
y	-	-	-0.172	0.766	1.791	0.002	-	-	-	-	-	-
c	-	-	-1.061	0.399	-1.971	0.165	-	-	-	-	-	-
e	-	-	-0.399	0.039	-0.800	0.002	-	-	-	-	-	-
p	-	-	-0.623	0.015	-0.417	0.433	-	-	-	-	-	-
R_2	-	-	0.110	-	0.520	-	-	-	-	-	-	-

Source: The authors.

Notes: 1Basic foods and beverages, mainly intended for industry; 2Processed foods and beverages, mainly intended for industry; 3Basic industrial inputs; 4Elaborated industrial inputs; 5Parts and accessories for capital goods; 6Parts for transportation goods.

Appendix 2: Estimated regressions for the subcategories of Consumer Goods

	Durable consumer goods		Semi-durable and non-durable consumer goods	
	2000/06-2010/11		2000/06-2009/07	
	Coef.	p-valor	Coef.	p-valor
β_0	-28.231	0.000	-12.939	0.000
y	2.191	0.000	1.584	0.000
c	4.796	0.000	2.661	0.000
e	-0.168	0.312	0.137	0.208
p	1.652	0.000	-0.089	0.524
R_2	0.899	-	0.725	-
-	2010/11-2016/07		2009/07-2018/03	
β_0	-53.926	0.000	-29.631	0.000
y	4.590	0.000	2.816	0.000
c	3.863	0.005	2.882	0.000
e	-1.063	0.000	-0.244	0.005
p	0.184	0.833	-0.818	0.002
R_2	0.948	-	0.963	-
	2016/07-2020/07		2018/03-2023/09	
β_0	-14.276	0.333	3.535	0.534
y	-0.325	0.787	1.651	0.000
c	9.837	0.006	-0.773	0.380
e	-1.092	0.001	-0.469	0.004
p	0.897	0.003	0.356	0.165
R_2	0.644	-	0.686	-
-	2020/07-2023/09		-	-
β_0	-10.593	0.380	-	-
y	3.253	0.000	-	-
c	-1.454	0.493	-	-
e	-1.480	0.001	-	-
p	1.297	0.187	-	-
R_2	0.788	-	-	-

Source: The authors.